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LOCAL VASCULAR EFFECTS OF HISTAMINE IONTOPHORESIS AND OF THE DIRECT CURRENT

A COMPARATIVE STUDY

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HISTAMINE iontophoresis is a technique well established in physiotherapy. It was introduced in 1931 simultaneously by Deutsch in the treatment of "painful rheumatic conditions", and by Gajdos-Förök for the treatment of muscular rheumatism and sciatica. These authors attributed the clinically favourable results obtained to a nervous reflex mechanism, i.e. counter-irritation.

There is no doubt of its efficiency as an irritant. The application of a 1 in 1,000 solution of histamine dihydrochloride or a 1% histamine jelly to the skin under the positive electrode with the passage of a low current for a short time (for example, 5 milliamperes for 5 minutes) is sufficient to cause an intense localized red patch. However, iontophoresis with histamine and other vasodilating drugs is also widely used "for improving circulation in rheumatic and other conditions" and "to relieve pain and muscle spasm and improve the blood flow in individual muscles" (Bach, 1950). Standard textbooks on physical medicine refer to the vasodilatory and counter-irritant effects of histamine and to the "local reaction extending to some depth" (Kovacs, 1945; Kiernander, 1953).

The same technique is frequently advocated to improve the circulation in both skin and muscle in peripheral vascular diseases. Again, some

authors consider that the passage of a direct current causes motor stimulation of the skin and "increased circulation and nutrition of the parts in the path of the current" (Osborne, 1950). Although a rise in skin temperature and local redness under the electrodes indicate an increased blood flow in the skin, there is no convincing evidence of increased blood flow in the deeper structures. It is emphasized that with the techniques adopted no systemic effects are produced; indeed the dosage is carefully adjusted individually to avoid generalized reactions.

Present Investigation

A convenient way to demonstrate changes in circulation in tissues at different depths is by the radioactive isotope clearance technique of Kety (1949), and this has been used to study the effects on skin and muscle clearance of the passage of a direct current and of histamine iontophoresis. The object of the experiments was to determine whether changes in local circulation did occur, particularly if vascular changes could be demonstrated in muscle deep to the electrode; for if histamine iontophoresis and the direct current act by their superficial counter-irritant effects alone, then they can be replaced by simpler, quicker, and more convenient methods of treatment.

The subjects investigated were all adults attending physical medicine out-patient clinics. None had evidence of peripheral vascular disease.

Method

The subject sat in a chair with arms comfortably supported at heart level and stabilized with sandbags. The room temperature remained constant for each observation, although it varied from day to day between 18° and 21° C. The injection site in each forearm was viewed through two shielded Geiger–Müller tubes, each pair being connected in parallel to a scaler. Two tubes were used so as to minimize the effects of small movements of the arm. The two arms were studied simultaneously, being shielded from one another by $3\frac{1}{2}$ inches of lead.

To study skin clearance, 0·1 to 0·4 ml. of isotonic saline containing 5 to 10 μc. of radioactive sodium (Na^{24}) was injected subcutaneously, and for the investigation of muscle clearance the injection was made into the belly of the brachioradialis at a depth of 1·5 cm. Counting started ten minutes after the injection and was repeated at one-minute intervals for fifteen minutes. A current of 5 to 7·5 mA was then switched on for both arms and maintained for ten to twenty minutes, counting being continued until constant background readings were obtained. The logarithm of counting rate minus background was then plotted against time. The slope of the resulting graph indicates the rate at which the Na^{24} is being removed. From it the clearance constant, k, which has

been shown by Kety to be a measure of local circulation, can be calculated by using the equation

$$k = \frac{\log C_1 - \log C_2}{0{\cdot}4343\,(T_2 - T_1)}$$

where C_1 and C_2 are counts per minute at time T_1 and T_2 respectively, and the time interval $T_2 - T_1$ is of sufficient duration—at least ten minutes—to allow a reliable slope to be drawn.

Technique for Passage of Direct Current.—For passing a direct current the anode consisted of a strip of Crookes metal $1\frac{1}{2} \times 2$ inches applied over eight thicknesses of lint soaked in warm water. This was bandaged to the forearm over the injection site and connected to the source, a battery-operated model Stanley Cox attaché galvanic unit. The cathode, which was four times the size of the anode, was similarly applied between the shoulders. To apply histamine iontophoresis an area of skin over the injection site equal in size to the anode was smeared with 1% histamine jelly and the apparatus connected up as above.

Skin temperature measurements were taken with a Cambridge skin thermometer at the site of the electrode before and after the passage of the current in a small group of subjects.

Results

I. Preliminary Experiments

Previous work (Harris *et al.*, 1952) has shown the relative symmetry of clearance rates from skin and muscle of similar sites in the arms or legs, and in addition that resting skin and muscle clearance rates remain constant for as long as one hour if no alteration is made in the environment. Symmetrical sites were therefore used in the forearms to compare the effects of histamine ionization with (*a*) application of a wet pad, and (*b*) the passage of a direct current.

(*a*) *Application of a Wet Pad.*—As the presence of a warm wet pad might have some effect on local circulation, the electrode was applied over soaked lint to one forearm and the effect on clearance from skin

TABLE I

Clearance Constants (k) from Subjects in Group *a* (Controls)

Tissue	Subject No.	Wet Pad		Histamine		Dose	
		k_1	k_2	k_1	k_2	Milliamps.	Mins.
Skin	1	0·058	0·058	0·060	0·085	5	10
	2	0·036	0·036	0·042	0·064	5	10
	3	0·038	0·038	0·044	0·056	5	10
Muscle	4	0·069	0·069	0·064	0·043	5	8
	5	0·028	0·028	0·040	0·028	5	10
	6	0·034	0·034	0·036	0·036	5	10

and muscle deep to it without any current passing was observed in 6 subjects (3 skin, 3 muscle). Histamine iontophoresis was applied to the other forearm. Results are given in Table I.

The clearance rate from both skin and muscle at the "wet pad" site remained constant, indicating that the presence of the pad alone had no effect on the rate. However, changes were observed in the histamine-treated arms. In general, an increase occurred in skin clearance, and either no change or a decrease in clearance from muscle. These effects were shown by the alterations in the slope of the clearance curves following the passage of the current, k_1 being the clearance constant of the tissue at rest, and k_2 the changed rate of clearance (recorded over a minimum

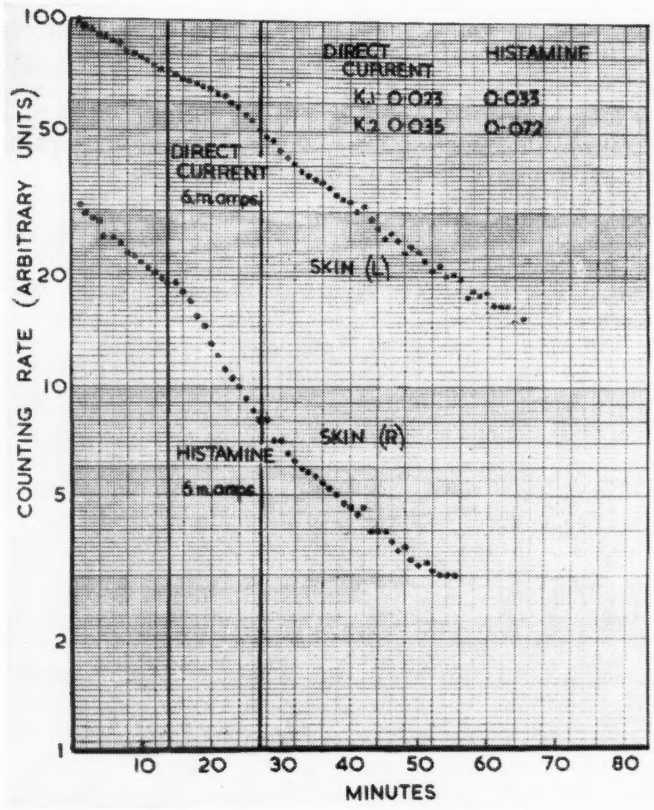

FIG. 1: Subject No. 10.—Rate of clearance of Na^{21} from skin of both forearms measured simultaneously during the passage of a direct current (L) and histamine iontophoresis (R). (To show the greater increase in clearance from the histamine-treated skin, and the relation of the changes to the passage of the current.)

period of ten minutes) found during, or shortly after, the passage of the current (see Figs. 1, 2, and 3).

(*b*) *Passage of a Direct Current.*—As the differences in Group *a* might have been due to the passage of a current alone and not to the histamine, the effect of passing a current ("galvanism", or direct current) was compared with the clearance changes occurring during histamine iontophoresis of both skin and muscle.

To compare the effect of histamine iontophoresis with that of a direct current on the clearance rate of *skin*, in eight subjects a direct current of 5 mA was passed for 12 to 15 minutes through one forearm, and simultaneously histamine iontophoresis with a current of the same strength and duration was carried out on the other forearm. The results (Table II) were closely similar. On the side given histamine iontophoresis an increase in the gradient of the clearance curve varying between 25% and 160%

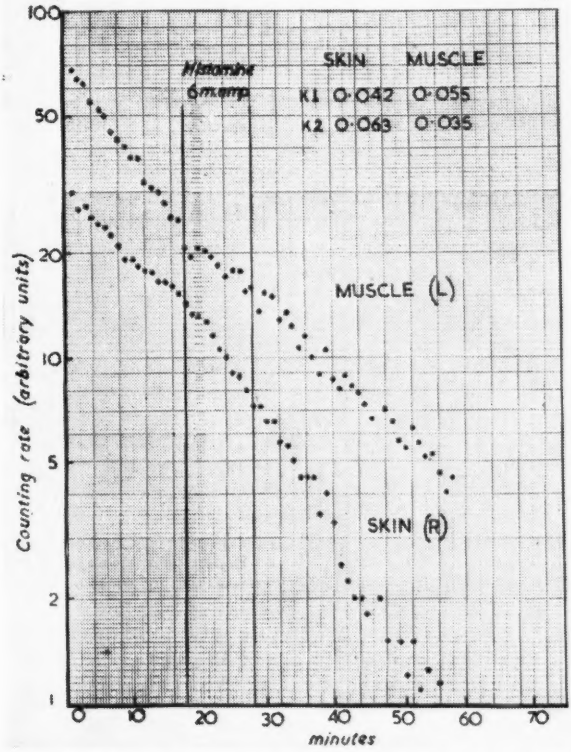

FIG. 2: Subject No. 31.—Rate of clearance of Na^{24} from skin of one arm and muscle of the other during simultaneous histamine iontophoresis of both arms. (To show increase in rate of clearance from skin and decrease in rate of clearance from muscle.)

was found in every case, and it was noted that this change was sudden and followed closely the switching on of the current. On the side to which the direct current was applied an increase occurred in only six subjects, there being no change in the other two; the increases were usually less than for the corresponding (histamine-treated) arm, and the changes were less abrupt and appeared after some delay. (See Fig. 1.) The value of the initial clearance (k_1) was generally markedly higher in arms having histamine iontophoresis than in those receiving direct current, thus indicating that the application of histamine jelly to the skin causes an increase in superficial circulation even without a current being passed. (This effect has not been allowed for in calculating the percentage change between initial and final clearance constants.)

To compare the respective effects of histamine iontophoresis and the passage of a direct current on *muscle* clearance, in eight subjects a current

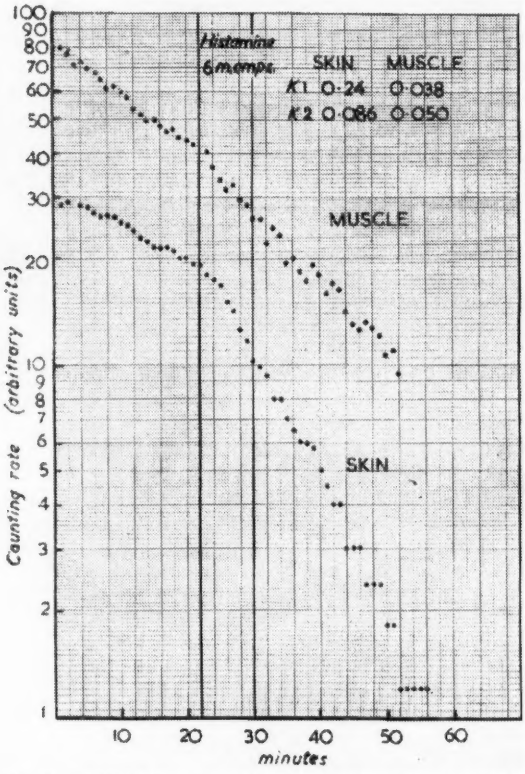

FIG. 3: Subject No. 30.—Rate of clearance of Na^{24} from skin of one arm (the k_1 value should read 0·024, and not as shown) and muscle of the other during simultaneous histamine iontophoresis of both arms. (To show increase in rate of clearance from both skin and muscle.)

Histamine Iontophoresis and Direct Current Compared

TABLE II

COMPARISON OF CLEARANCE RATE FROM SKIN DURING HISTAMINE IONTOPHORESIS AND THE PASSAGE OF A DIRECT CURRENT OF EQUAL STRENGTH AND DURATION

Subject No.	Direct Current		Histamine		Dose	
	k_1	k_2	k_1	k_2	Milliamps.	Mins.
7 ..	0·032	0·050	0·052	0·092	5	13
8 ..	0·008	0·022	0·024	0·060	5	15
9 ..	0·031	0·031	0·041	0·054	5	15
10 ..	0·023	0·035	0·033	0·072	5	13
11 ..	0·029	0·036	0·033	0·085	5	13
12 ..	0·032	0·032	0·046	0·069	5	15
13 ..	0·023	0·061	0·044	0·056	5	12
14 ..	0·026	0·059	0·020	0·048	5	12
Mean value ..	0·026	0·041	0·036	0·067	5	13
% change ..	+58%		+86%			

of 5 to 7·5 mA was passed for 10 to 20 minutes through one forearm and histamine iontophoresis with a current of the same strength and duration carried out on the other forearm. The results were variable, but in general closely similar. The clearance rate was either unaffected or decreased, and the changes were approximately of the same order in both cases, with decreases ranging up to 60%. The changes were gradual in both arms and followed the switching on of the current by a variable period, usually three to five minutes. (Table III.)

These preliminary experiments clearly indicate:

(1) That the passage of a direct current itself has effects on both skin and muscle deep to the electrode.

TABLE III

COMPARISON OF CLEARANCE RATE FROM MUSCLE DURING HISTAMINE IONTOPHORESIS AND THE PASSAGE OF A DIRECT CURRENT OF EQUAL STRENGTH AND DURATION

Subject No.	Direct Current		Histamine		Dose	
	k_1	k_2	k_1	k_2	Milliamps.	Mins.
15 ..	0·032	0·032	0·031	0·031	7·5	10
16 ..	0·041	0·041	0·073	0·031	7·5	10
17 ..	0·067	0·036	0·027	0·015	5	18
18 ..	0·068	0·060	0·063	0·047	6	10
19 ..	0·035	0·035	0·036	0·036	6	12
20 ..	0·055	0·048	0·059	0·059	6	12
21 ..	0·052	0·024	0·039	0·028	5	20
22 ..	0·033	0·033	0·044	0·020	5	20
Mean value ..	0·048	0·039	0·047	0·033	6	14
% change ..	−19%		−31%			

(2) That in general the effect is to increase the circulation in skin and subcutaneous tissue and slightly decrease circulation in muscle.

(3) That these effects are magnified by the presence of histamine ions.

II. Comparative Effects of Histamine Iontophoresis on Skin and Muscle Clearance

The effects of histamine iontophoresis on skin and muscle clearance of Na^{24} were compared in ten subjects. A current of 5 to 6 mA was passed for 5 to 25 minutes simultaneously through symmetrical sites on each forearm and the clearance rate from skin of one arm and from muscle of the other studied.

Generalized reactions occurred in three subjects (Nos. 24, 30, and 32), and these are considered separately (Table IVB). With these exceptions the results (Table IV) agree closely with those obtained in the preliminary experiments. Skin clearance rates increased in all subjects by between 50% and 350%—decidedly greater increases than in the preliminary experiments. Muscle clearance was variable, and of the seven subjects in Table IVA four showed virtually no change, two showed decreases of between 40% and 50%, and one an increase of 40%. Two of the three

TABLE IV

Comparison of Clearance Rates from Skin and Muscle during Histamine Iontophoresis

A. *No Systemic Reaction*

Subject No.	Skin		Muscle		Dose	
	k_1	k_2	k_1	k_2	Milliamps.	Mins.
23 ..	0·042	0·105	0·020	0·022	6	12
25 ..	0·037	0·092	0·027	0·027	6	14
26 ..	0·027	0·054	0·041	0·058	6	12
27 ..	0·027	0·064	0·026	0·026	6	12
28 ..	0·042	0·073	0·110	0·066	5	5
29 ..	0·014	0·065	0·046	0·046	6	25
31 ..	0·042	0·063	0·055	0·035	6	10
Mean value ..	0·033	0·074	0·046	0·039	6	13
% change ..	+124%		−15%			

B. *Systemic Reaction*

24 ..	0·031	0·082	0·046	0·100	6	10
30 ..	0·024	0·086	0·038	0·050	6	7
32 ..	0·090	0·118	0·029	0·054	6	8
Mean value ..	0·048	0·095	0·038	0·068	6	8
% change ..	+98%		+79%			

subjects having a generalized "histamine reaction" (Nos. 24 and 32) suffered severe collapse. It will be noted that all three cases gave high skin clearance values and that in all three muscle clearance increased considerably (Table IVB).

The results of these experiments clearly indicate that histamine iontophoresis in dosage insufficient to cause a generalized reaction is more efficient than the passage of a direct current alone in increasing local circulation in the skin. Also the effect on muscle circulation is not predictable, but unless a systemic reaction is produced local circulation in muscle will be either unaffected or decreased.

As histamine iontophoresis was carried out simultaneously on both forearms, double the amount of histamine was introduced compared with the preliminary experiments. This increased amount of histamine would probably account for the higher skin clearance rates found in this series of experiments.

III. Local and Remote Effects on Muscle Circulation of Histamine Iontophoresis

In five subjects histamine iontophoresis with a current of 14 mA was applied to one forearm until a generalized reaction was obtained, the time for which the current was passed varying between 12 and 27 minutes. Clearance rates were measured simultaneously from muscle in the treated and untreated arms, so that both local and remote effects of histamine iontophoresis on muscle circulation could be studied.

Severe systemic reactions were noted in two subjects (Nos. 33 and 34), and these both showed large increases in clearance rate. Minor reactions were obtained in the other three, and in these the changes in rate varied. In general, any changes found were symmetrical: if the rate of clearance from the treated side altered, then that from the remote side altered in the

TABLE V

Comparison of Clearance Rates from Muscle during Histamine Iontophoresis at the Site of Treatment and in the Contralateral Arm

Subject No.	Untreated Arm		Treated Arm		Dose	
	k_1	k_2	k_1	k_2	Milliamps.	Mins.
33 ..	0·044	0·068	0·030	0·062	14	27
34 ..	0·027	0·035	0·028	0·040	14	15
35 ..	0·079	0·039	0·063	0·034	14	16
36 ..	0·036	0·046	0·034	0·046	14	12
37 ..	0·064	0·064	0·064	0·045	14	12
Mean value ..	0·050	0·050	0·044	0·045	14	16
% change ..	0%		+2%			

same direction. Two subjects actually showed a decrease. The greatest increases were found in subjects with the most marked systemic reactions, and, though changes were greater in the treated muscle, the final clearance rates of both treated and remote muscle were of much the same order. This is clearly shown in Table V.

From this investigation it appears that even a massive localized treatment with histamine by iontophoresis will not consistently produce an increase in circulation in muscle beneath the active electrode unless a severe systemic reaction occurs. Even then the changes in local and remote muscle are of the same order.

Discussion

In an investigation previously reported (Harris *et al.*, 1952) we found the mean value of the clearance constant from skin on full reflex vasodilatation to be 0·067 (±0·018). This indicates that in our experiment with histamine iontophoresis, where similar values have been found, a maximal response has been shown by the skin circulation, thus confirming the adequacy of the technique and dosage used. In contrast to this, full vasodilatation was not reached with the direct current used alone. The experiment clearly demonstrates the superiority of histamine iontophoresis over the direct current in producing skin effects, although this was not really in question, as clinical observation readily shows this. Neither the direct current nor histamine iontophoresis had a major effect on the clearance of Na^{24} from muscle; in general a small decrease in clearance was found. Only when a generalized reaction to histamine occurred was a large change found in muscle clearance, and in this group the greatest increase noted (165%) was no more than occurs in muscle under the stimulus of very light exercise. Further, with a massive local dose of histamine by iontophoresis no increase is found in muscle clearance on the treated site unless systemic effects sufficient to cause an increase in clearance of the same order from remote muscles are produced.

There is thus no evidence from our experiments to support the use of histamine iontophoresis or the direct current in an attempt to improve circulation in muscle. However, both these techniques are efficient in relieving localized pain, particularly if it is fairly superficial. The physiological mechanisms of pain relief by counter-irritation are not completely understood. All counter-irritants stimulate sensory nerve-endings, giving rise to local pain and causing cutaneous vasodilatation by an axon reflex. To the sensory stimulation of the current, histamine also contributes a direct superficial vasodilatory effect, which serves to increase the vasodilatation caused by the current itself. Whether or not this is really of value as a counter-irritant mechanism is doubtful. MacArthur and Alstead (1953), who compared the effect of counter-irritants on pain induced by deep injection of hypertonic saline (Kellgren, 1949), con-

cluded that the relief of deep-seated pain by counter-irritation depends on the production of skin stimulation of adequate intensity, and that cutaneous vasodilatation is unimportant. As our experiments have indicated that the vascular effects of both histamine iontophoresis and passage of a direct current in clinical dosage are almost entirely superficial, there appears to be no advantage in using these techniques instead of simpler and quicker methods of counter-irritation.

Summary

1. The radioactive isotope clearance technique of Kety has been used to study effects on local circulation in skin and muscle during the passage of a direct current and during histamine iontophoresis in 37 normal subjects.

2. Both these techniques increase skin circulation, but for the same strength and duration of current (5 to 7·5 mA for 10 to 20 minutes) histamine iontophoresis gives an increase in skin circulation about 100% greater than the direct current alone.

3. The changes found in muscle circulation were minor, usually taking the form of a decrease. A large increase in muscle circulation was found only when a generalized histamine reaction occurred.

4. It is concluded that the main effect of both the direct current and histamine iontophoresis is superficial, and that neither technique is of value in producing circulatory effects deep to the skin.

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THE FUNCTION OF THE VASTUS MEDIALIS MUSCLE

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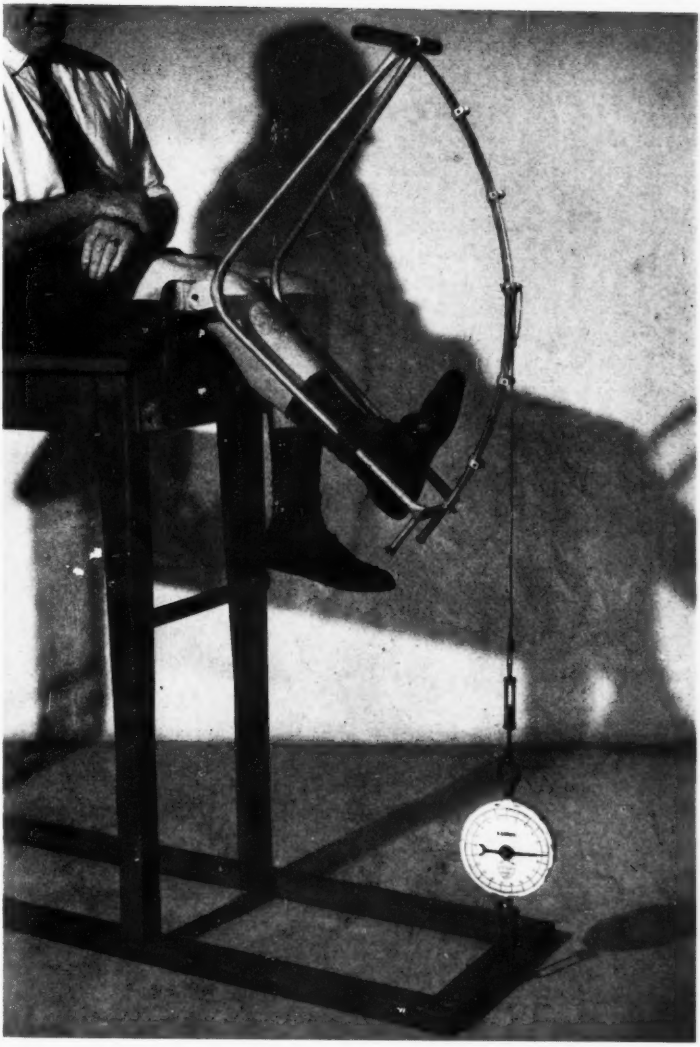
IT is commonly stated that the vastus medialis has a selective action and contracts strongly only during the last fifteen degrees of extension. This belief has had a marked influence on the design of apparatus and exercises for strengthening the quadriceps, yet a search of the literature reveals no proof that it is true. Consequently an investigation was undertaken to determine whether the vastus medialis does in fact have this selective action.

Mechanical Measurements of the Force with which the Knee can be Extended in Different Degrees of Extension

The quadriceps femoris has two main functions—to extend the knee and to control its flexion. Up to a point the knee may be considered as a hinge, with flexion and extension being movements of the tibia about an imaginary axis passing through the femoral condyles. Consequently quadriceps function can be measured in terms of the force with which the knee is extended on voluntary contraction. Alternatively, a measurement can be made of the flexion force which must be applied to make the knee give way. If these forces are measured at right-angles to the tibia and at a fixed distance from the femoral condyles the results can be expressed in terms of moments about this point (torque).

The apparatus used for such measurements (Plate XXXI) consists of a light metal quadrant pivoted at points opposite the femoral condyles. Measurements are made by means of a calibrated spring which can be attached to different points arranged at fifteen-degree intervals around the arc. The radius of the quadrant is 22 inches.

First a series of measurements were made while the subject was contracting his quadriceps maximally in different degrees of extension (90°, 120°, 150°, 165°, and 175°). Secondly the knee was locked at 180°, and with the quadriceps contracting maximally an increasing flexion force was applied until the knee gave way. This force was measured by means of a calibrated spring. Finally, with the quadriceps relaxed, the force which must be applied to balance the effect of gravity on the leg in different positions was measured. In Fig. 1 these measurements are expressed in the form of a graph. The figures shown are an average of the results obtained from the ten normal men (aged 20 to 40) used in the experiment. Many other observations have been made in normal subjects, and they confirm the pattern of these results.



The "quadrant". This picture shows a measurement being made at 135° of extension. The spring records the torque in terms of the force exerted at a point 22 inches from the femoral condyles.

This study of quadriceps function has demonstrated that the maximum torque that can be induced by quadriceps contraction declines as full extension is approached. This is not because fewer fibres are contracting, but because the extensor apparatus is mechanically less efficient in this position.

Palpation of the Vastus Medialis during Function

Clinical observations may be misleading unless the actual forces involved are calculated. An example of this is provided by the following manœuvre, which is commonly used to demonstrate the selective action of the vastus medialis. The patient sits on the edge of a table and then raises one leg until the knee is fully extended. Vastus medialis contraction is then obvious only during the last few degrees of extension. Fig. 1 reveals the fallacy in this demonstration. As full extension is approached the quadriceps as a whole is mechanically inefficient and at the same time the effect of gravity is at a maximum. Consequently the quadriceps needs to contract strongly only during the last few degrees of extension. In fact palpation will show that contraction in this position occurs throughout the quadriceps and is not confined to the vastus medialis.

Provided that care is taken to ensure that the other divisions of the quadriceps are contracting strongly, then the vastus medialis will be found to be firm and prominent whatever the degree of extension. The truth of this statement can be demonstrated by palpating the muscle while the subject is getting out of a chair, running, climbing stairs, or indeed carrying out any activity which involves weight-bearing with the knee flexed.

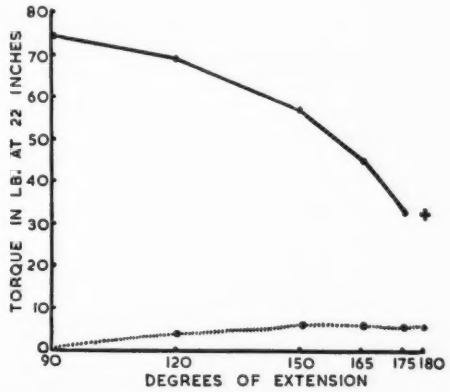
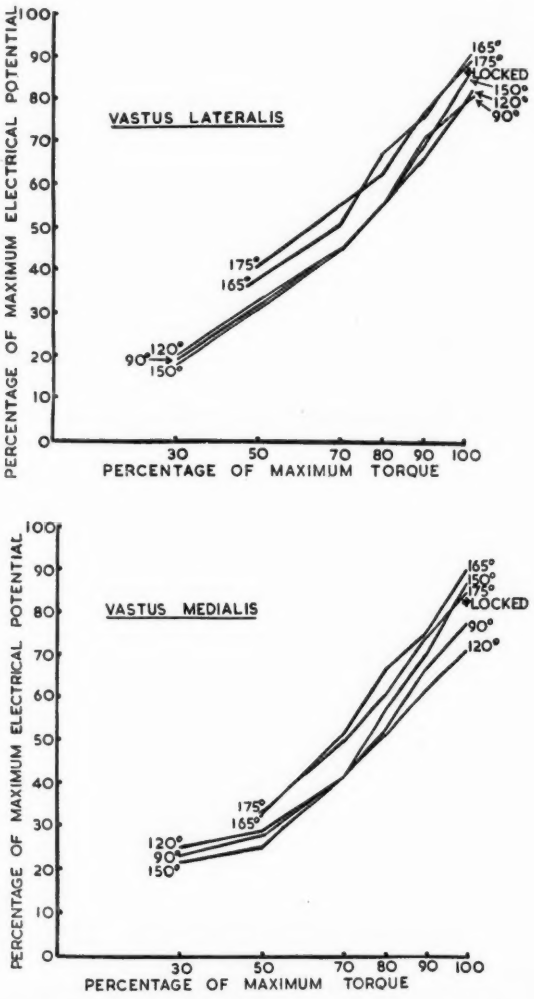


FIG. 1.—Measurements made with the "quadrant". The continuous line represents the torque induced by maximum contraction in different degrees of extension. Corrections have been made to allow for the weight of the leg and of the apparatus. The cross represents the force which must be applied to flex the knee when it is locked and the quadriceps is contracting maximally. Similar corrections have been made. The dotted line represents the torque required to overcome the effect of gravity on the leg in different positions.

Electromyographic Investigation

An electromyograph was adapted so that a voltmeter would record the electrical potential at the skin over a contracting muscle. It was fitted with a peak-reading valve voltmeter with a long time constant, and for the purposes of these experiments a low-time-constant amplifier was used to



FIGS. 2 and 3.—Measurements of electrical potential over the vastus lateralis and vastus medialis when contracting against forces of increasing intensity and at different degrees of extension. The figures are averages of the results obtained from ten normal young men.

reduce the low-frequency response associated with movement of the leads. With the use of skin electrodes it was shown that for practical purposes the electrical potential over a contracting muscle was proportional to the force of contraction as measured with a calibrated spring.

Measurements were made of the electrical potential over the quadriceps during the performance of "isometric" contractions against calibrated resistance in different degrees of extension and when the knee was locked. Each subject performed a series of contractions measured simultaneously on the calibrated spring and the voltmeter with skin electrodes attached first over the vastus medialis and later over the vastus lateralis. Measurements were made at 90°, 120°, 150°, 165°, and 175°, and with the knee locked for contractions of 30%, 50%, 70%, 80%, 90%, and 100% of the maximum torque in each position as measured with the calibrated spring. Care was taken to avoid fatigue. The figures for electrical potential over a muscle vary according to the preparation of the skin and the position of the electrodes. Consequently all measurements for one muscle were made on the same occasion without moving the electrodes; they were then expressed as percentages of the highest figure obtained with that position of the electrodes.

Figs. 2 and 3 show the results obtained with this method, the figures in the graphs being averages of the results obtained from ten normal young men. There is no significant difference as between the two muscles. Although the electrical potential at 165° and 175° is above average, it is clear that there is a high level of potential over the vastus medialis when it is contracting with the knee flexed.

With these measurements as guides, records were made of electrical potential while subjects were performing active movements. This demonstrated comparable levels over the two muscles during standard procedures (see Table).

ELECTRICAL POTENTIAL DURING PERFORMANCE OF ACTIVE MOVEMENTS

Procedure	Electrical Potential	
	Vastus medialis	Vastus lateralis
Stepping up 6-inch step	16–21%	16–22%
Stepping up 12-inch step	30–45%	30–40%
Knee bend to a right-angle, taking the body weight on one leg ..	50–80%	45–85%

Needle electromyography was considered unsuitable for this study, as maximum contraction with a needle in place is a painful procedure. However, enough measurements were made by this method to confirm the general pattern of results when skin electrodes were used.

Hypertonic Saline Injections

Immediately after an injection of hypertonic saline into muscle, continuous pain is felt, but after a short period pain is appreciated only after contraction of moderate intensity. At this stage a careful observer is left in no doubt as to which activities require contraction of the injected muscle.

Hypertonic saline (1 ml. of 5% sodium chloride) was injected into the vastus lateralis of normal individuals, and they were then asked to try out a variety of activities during the following twenty-four hours, their reactions being noted. At a later date the experiment was repeated with injections into the vastus medialis. The findings were identical for both muscles. Pain occurred mainly during weight-bearing with the knee flexed —running, walking up or down stairs, getting out of a chair, or rising from a kneeling position. It also occurred if the quadriceps was voluntarily strongly contracted in full extension, but pain was virtually absent from both muscles during walking on level ground, indicating that strong contraction of the quadriceps is not essential for this.

Conclusions

In this investigation no evidence was found to support the view that the vastus medialis muscle contracts strongly only during the last fifteen degrees of extension. It also contracts strongly in flexed positions both against resistance and during everyday activities.

Summary

The theory that the vastus medialis muscle contracts strongly only during the last fifteen degrees of extension of the knee has been investigated in five ways:

1. Palpation of the muscle while it is contracting against a measured resistance in different degrees of extension.
2. Palpation of the muscle during function.
3. Electromyographic measurements of electrical potential over the muscle while it is contracting against a measured resistance in different degrees of extension.
4. Electromyographic measurements during function.
5. The appreciation of pain during function after an injection of hypertonic saline into the muscle.

The findings of the investigation failed to confirm such a theory.

Acknowledgments

I would like to thank Dr. F. S. Cooksey for his help and encouragement.

The electromyograph used was made in the Physics Department at King's College Hospital, and I am indebted to Mr. Bareham and Mr. Kitchen, of that Department, for much technical advice and assistance.

AN ALTERNATIVE TECHNIQUE OF TREATING THE HIP WITH SHORT-WAVE DIATHERMY

By BRYAN O. SCOTT

From the Radcliffe Infirmary, Oxford

ALTHOUGH it is generally accepted that short-wave diathermy is of value in the treatment of osteoarthritis of the hip, it is not yet known exactly where the heat should be concentrated to achieve the best results. The present view is that the deeper the heat the better the effect, though this may have to be modified in the light of recent work by Harrison, Shajowitz, and Trueta (1953), which suggests that an increase rather than a decrease in blood flow to the femoral head is an important aetiological factor in osteoarthritis of the hip.

In an endeavour to obtain the most effective heating of the hip-joint and its surrounding capsule, Bauwens devised a method of "cross-fire" short-wave diathermy. This constituted a great advance on the two-condenser electrode method, which it has been demonstrated in phantoms does not efficiently heat the hip. There are probably two reasons for this: (1) flat electrodes are opposed, one to a convex surface and the other to a concave surface, which results in the effective size of the electrodes being greatly reduced (see Fig. 1) as the current concentrates upon small

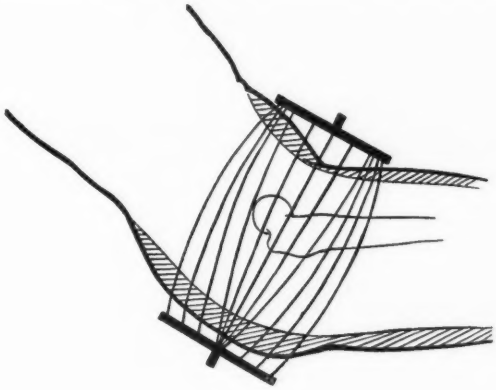


FIG. 1

areas of skin, the tolerance of which is the limiting factor of the current passed; and (2) the large mass of fatty tissue in which the field is concentrated; this heats up greatly (Bauwens, 1940; Scott, 1954), and again limits the total dosage delivered to the hip and adjacent tissues.

In this paper a new technique for treating the hip-joint with short-wave diathermy is described and the results obtained in a controlled series of patients with osteoarthritis of the hip are discussed.

Technique

In this method, designed to overcome the deficiencies referred to above, a coil electrode around the thigh is employed as a condenser electrode, the free end being insulated. (A rubber walking-stick ferrule serves very well, as shown in Plate XXXII.) For the other electrode a pad as large as possible is placed over the lower lumbar muscles, the sacrum, and the gluteal attachments. If the patient is placed in a sitting position on a plinth, with this arrangement the hip-joint is in the axial line of the field (Fig. 2).

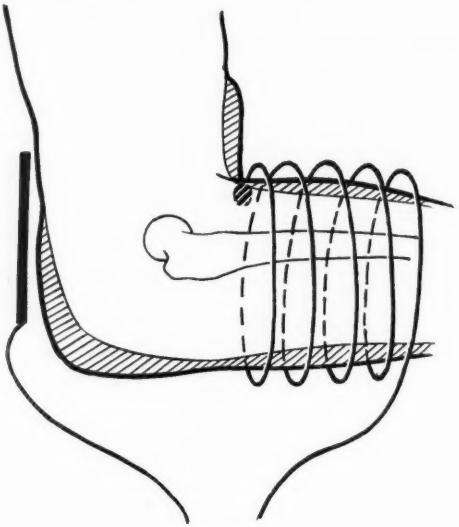


FIG. 2

Occasionally the apparatus with this electrode arrangement will not tune owing to the range of the variable condenser in the patient's circuit being insufficient. Should this difficulty be encountered a smaller pad placed behind the sacrum and/or separating the coils of the coil electrode will alter the capacity sufficiently to enable tuning to be effected. The coil electrode must be wound inductively, since its capacity depends upon its inductance. It is essential for the bare end of the coil to be insulated.

Theoretically this technique has the advantages that the coil electrode (used as a cuff-shaped condenser) has the same effect as a virtual electrode

PLATE XXXII

Showing the position of the electrodes in applying short-wave diathermy to the hip.

at a cross-section immediately below the hip (Figs. 3 and 4) and it has a large effective area (approximately 60 square inches), the concentration of the field in the tissue fat being reduced and current concentration in the muscles encouraged. Similarly the large electrode over the sacrum allows the current easy access to the gluteal and psoas muscles; thus the

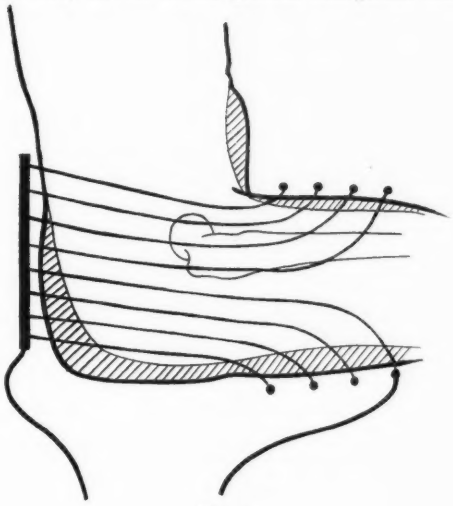


FIG. 3

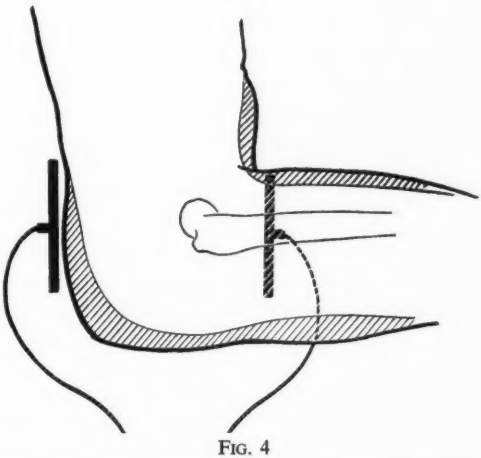


FIG. 4

current is introduced into muscles which pass around the joint being treated. Further, because the field strength is reduced in the dosage-limiting tissues of skin and fat it can concentrate in the muscles: thus a far greater dosage can be given.

Method of Investigation

Forty-four patients with osteoarthritis of the hip have been treated with short-wave diathermy. All did exercises in addition. Each patient received eight treatments with the standard technique and eight by the method described in this paper. Twenty-three were treated with coil and pad first, and twenty-one received the standard technique first. Results were assessed both subjectively and objectively.

After the treatments were completed patients were asked which of the two methods had suited them the better and the reasons for their choice. They were then asked directly which was the more comfortable, and whether one relieved the pain longer than the other or enabled them to walk better. Any other remarks were also noted.

Objectively an unbiased attempt was made to estimate which treatment led to the greater improvement; this included observing and timing the walking over a given distance and measuring the movements of the joints before and after each treatment. The opinion of unbiased observers was sought whenever possible.

Results

Of the 44 cases, 9 did not fulfil all the necessary conditions of the trial and were therefore excluded from the final assessment. Of the remaining 35 patients, 26 (74%) preferred coil and pad technique and 6 (17%) the condenser technique; 3 (9%) stated no preference. Of those preferring the coil and pad method, 22 (85%) chose this on the grounds of comfort, 17 (65%) because of pain relief, and 17 because of easier walking.

As soon as the technique was changed, several patients volunteered that they preferred the coil and pad technique, and in four cases the relatives immediately noticed the improvement. It was noted that a larger dose could be given with the coil and pad, although no accurate figures are available, since the apparatus had no wattmeter. Many patients reported that the condenser technique had little effect on the pain and was inclined to burn the skin.

Objectively it was thought that 46% improved clinically when treated with the coil and pad technique, compared with 20% with the condenser technique. It was considered that the majority of patients had greater improvement from the coil and pad technique, but objectively the difference between the two treatments was less easy to assess. One reason for this was the difficulty of remaining unbiased, although another opinion was sought wherever possible. This problem was aggravated by the fact that some patients who professed to be greatly improved had no change in their movements or walking, and vice versa. Walking appeared to be improved more by the coil and pad method, but again it was difficult to carry a mental picture of a patient's walk from one examination to the next, and bias cannot be excluded.

Treatment of Hip with Short-wave Diathermy

In three cases with bilateral osteoarthritis of the hip the standard technique was employed on the better of the two hips and the coil and pad on the other, both hips being treated concurrently. In all cases the worse hip became less painful than the opposite side, and in two cases the patient requested to have the "hose" on the other side.

Comment

The coil and pad technique appears to help patients with osteoarthritis of the hip more than the standard condenser technique. This is confirmed by all the physiotherapists who have employed the technique, in spite of the greater difficulty of its application. The theoretical advantages of the coil and pad technique seem to be substantiated on clinical grounds in that it appears to be more comfortable for the patient, a larger current can be passed, and the relief of pain is greater.

In this pilot investigation a small number of cases only were treated, and although subjectively the coil and pad technique seems to give significantly better results, objectively the difference is not so marked. Further work on the subject is clearly indicated.

Summary

A new ("coil and pad") technique for applying short-wave diathermy to the hip, designed to overcome the disadvantages inherent in the standard condenser method, is described.

A pilot investigation in 44 cases of osteoarthritis of the hip treated alternately with the two methods resulted in clinical improvement being obtained in 46% with the new technique as against 20% with the standard method.

The advantages of the coil and pad technique appear to be: (1) greater comfort for the patient; (2) a larger current can be passed; and (3) greater relief of pain.

It is concluded that further investigation is necessary.

Acknowledgments

I would like to express my thanks to Miss A. M. Hutcheson, Mrs. L. P. A. Newborne, and Miss V. M. Green for their co-operation in applying the new technique, and to Miss M. McLarty for the diagrams.

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COMPARISON OF RUBEFACIENT OINTMENTS BY SKIN TEMPERATURE ESTIMATIONS

By H. F. B. SYMONS

From the Department of Physical Medicine, St. George's Hospital, London

MEDICAL history contains many references to the treatment of pain by application of rubefacients to the skin. Turpentine was advocated by Hippocrates; camphor by the Byzantine physician Actius of Amida (*circa* A.D. 550); salicylic acid by Paracelsus; and the seed of black mustard by Hufeland. Nowadays there is a large and ever-growing number of proprietary ointments possessing rubefacient properties, and these are used in order to relieve pain arising from muscles, tendons, ligaments, and joints.

A good rubefacient ointment would seem to have a definite place in current therapeutics. It is a remedy that can be applied by the patient in his own home, thus saving a considerable amount of time for physiotherapists and leaving them free for more urgent cases. It was with this in mind that recent trials were conducted in the Physical Medicine Department at St. George's Hospital with the object of deciding by means of skin temperature estimations which of three rubefacient ointments was the most efficient. It is very difficult to compare such remedies objectively. Nearly all, if not all, clinical reports of their efficacy have been based on subjective impressions. Comparison of the rubefacient properties of ointments by means of skin temperature estimations provides a method of assessment which is independent of the opinion of the patient.

Three well-known and widely used ointments were taken for this trial, being labelled "F", "Y", and "Z" respectively. The essential constituents of "F" are the β-butoxyethylic ester of nicotinic acid and nonylic acid vanillylamide; "Y" contains histamine, and "Z" is a nicotinic acid ester. The trial was conducted upon a group of 29 patients, of whom 18 had osteoarthritis, 5 rheumatoid arthritis, and 6 fibrositis.

Method

An electrical thermometer was used to measure the skin temperature. This included a sensitive galvanometer calibrated from 0° to 50° C. Temperatures were recorded by means of six copper–constantan thermocouple wires of small diameter connected to six pairs of terminals constructed of the same materials. The bimetallic junctions were made by cleaning the ends of the copper and constantan wires, twisting them together for about 5 mm., and soldering them at the tip. These constituted the junctions for application to the skin of the patient.

Comparison of Rubefacient Ointments

In each case the temperature was measured at three separate points in the area of skin covering the painful joint or muscle. A small quantity of ointment "F" was then rubbed into the first of these areas, of "Y" into the second, and of "Z" into the third. Thereafter the temperature at each of the three points was recorded every fifteen minutes for one hour.

The procedure was repeated on different patients, varying only as to the site of the pain. This, of course, determined the site of the skin temperature estimations. Some patients were not able to remain in the department for a whole hour; in these cases recordings were made every fifteen minutes for as long as they could stay.

Results

It will be seen from the table below that all three rubefacients caused the skin temperature to rise, but not all by the same amount. Oint-

TABLE OF RESULTS

Case No.	Diagnosis	Site of Application of Thermocouples	Ointment Used	Temperature (° C.) at					Maximum Temperature Change (° C.)
				0′	15′	30′	45′	60′	
1	Osteoarthritis of L. ankle	3 areas inner aspect L. ankle	F	28·0	29·0	29·5	29·5	—	+ 1·5
			Z	29·0	29·0	29·5	29·5	—	+ 0·5
			Y	29·0	29·25	29·0	29·0	—	+ 0·25
2	Osteoarthritis of cervical spine	R. biceps	F	32·0	32·0	33·1	33·7	32·9	+ 1·7
		R. brachio-radialis	Z	30·5	31·4	31·5	31·5	31·2	+ 1·0
		R. deltoid	Y	33·8	34·5	33·9	33·4	33·8	+ 0·7
3	Osteoarthritis of L. knee	3 areas suprapatellar region	F	30·0	33·5	34·4	33·5	33·5	+ 4·4
			Z	30·0	32·5	32·2	32·7	32·3	+ 2·7
			Y	29·0	31·5	32·3	32·5	31·9	+ 3·5
4	Osteoarthritis of L. knee	3 areas infrapatellar region	F	31·0	32·8	34·4	34·8	—	+ 3·8
			Z	30·6	33·0	33·5	34·0	—	+ 3·4
			Y	32·2	33·2	34·4	34·5	—	+ 2·3
5	Osteoarthritis of hands	Carpo-metacarpal joint R. thumb	F	30·2	31·5	33·5	32·4	—	+ 3·3
		Middle dorsum R. wrist	Z	28·4	30·6	31·5	31·4	—	+ 3·1
		Carpo-metacarpal joint R. little finger	Y	28·6	31·0	31·0	30·3	—	+ 1·4
6	Osteoarthritis of cervical spine	Belly R. deltoid	F	34·3	34·8	35·0	34·6	—	+ 0·7
		Insertion R. deltoid	Z	33·0	33·4	33·3	33·5	—	+ 0·5
		R. biceps	Y	35·5	35·7	35·5	35·3	—	+ 0·2
7	Osteoarthritis of lumbo-dorsal spine	3 areas at level of L1	F	32·5	33·4	33·7	33·5	—	+ 1·2
			Z	33·0	32·7	32·6	32·0	—	− 1·0
			Y	32·8	32·5	32·5	33·0	—	+ 0·2
8	Osteoarthritis metatarso-phalangeal joints of R. foot	3 areas R. foot	F	26·7	27·5	28·5	29·0	—	+ 2·3
			Z	27·8	28·2	29·5	29·8	—	+ 2·0
			Y	28·1	27·5	29·0	30·0	—	+ 1·9
9	Osteoarthritis of R. knee	3 areas at back of R. knee	F	30·0	32·7	32·5	35·4	—	+ 5·4
			Z	30·0	30·8	32·0	32·5	—	+ 2·5
			Y	30·7	32·0	32·3	32·5	—	+ 1·8
10	Cervical spondylosis	3 areas of R. trapezius	F	31·5	33·7	34·7	33·8	—	+ 3·2
			Z	31·2	31·0	32·0	32·2	—	+ 1·0
			Y	31·5	32·4	32·8	33·7	—	+ 2·2

Table continued overleaf

TABLE OF RESULTS—*continued*

Case No.	Diagnosis	Site of Application of Thermocouples	Ointment Used	Temperature (° C.) at					Maximum Temperature Change (° C.)
				0′	15′	30′	45′	60′	
11	Osteoarthritis of lumbar spine	R. sacro-iliac joint	F	29·2	31·5	32·6	33·4	—	+ 4·2
		L. sacro-iliac joint	Z	29·5	31·7	32·0	32·4	—	+ 2·9
		Midline between sacro-iliac joints	Y	29·5	32·5	33·2	34·4	—	+ 4·9
12	Osteoarthritis of L. knee	3 areas suprapatellar region	F	27·8	28·6	30·4	32·1	—	+ 4·3
			Z	29·0	28·4	28·6	28·5	—	− 0·6
			Y	28·3	28·9	30·5	29·9	—	+ 2·2
13	Osteoarthritis of sterno-clavicular joints	L. sterno-clavicular joint	F	32·3	35·0	36·3	35·8	—	+ 4·0
		R. sterno-clavicular joint	Z	31·7	33·5	35·0	35·0	—	+ 3·3
		Area between sterno-clavicular joints	Y	32·7	33·2	34·5	33·6	—	+ 1·8
14	Osteoarthritis of hands	3 areas in palmar aspect of R. wrist	F	34·3	35·7	36·5	36·6	—	+ 2·3
			Z	33·0	35·0	34·6	35·2	—	+ 2·2
			Y	33·0	33·5	34·5	34·0	—	+ 1·5
15	Osteoarthritis of L. knee	3 areas in suprapatellar region	F	31·5	33·5	33·7	33·6	—	+ 2·2
			Z	30·4	29·5	32·4	32·6	—	+ 2·2
			Y	31·0	32·5	32·5	32·5	—	+ 1·5
16	Osteoarthritis of lumbar spine	3 areas at level of L4	F	34·1	36·0	—	36·0	—	+ 1·9
			Z	34·2	36·0	—	35·7	—	+ 1·8
			Y	34·2	35·6	—	35·5	—	+ 1·4
17	Osteoarthritis of R. knee	3 areas in infrapatellar region	F	31·2	32·4	32·5	33·6	—	+ 2·4
			Z	31·5	32·6	33·0	33·5	—	+ 2·0
			Y	30·0	31·0	32·0	31·6	—	+ 2·0
18	Osteoarthritis of knees	3 areas in suprapatellar region of R. knee	F	32·0	33·8	35·4	35·5	—	+ 3·5
			Z	31·0	31·2	34·2	34·5	—	+ 3·5
			Y	31·0	32·3	33·0	32·5	—	+ 2·0
19	Rheumatoid arthritis of wrists and hands	3 areas on dorsum of R. wrist	F	29·0	31·7	31·7	30·8	—	+ 2·7
			Z	31·0	33·0	31·5	31·6	—	+ 2·0
			Y	30·5	31·7	32·5	31·7	—	+ 2·0
20	Rheumatoid arthritis of knees and hands	3 areas on R. knee	F	32·5	32·6	33·2	32·5	31·7	+ 0·7
			Z	31·5	30·2	31·8	31·7	31·0	+ 0·3
			Y	34·0	33·9	33·0	34·0	33·7	− 1·0
21	Rheumatoid arthritis of knees and hands	3 areas on dorsum of R. wrist	F	31·5	33·5	33·8	33·5	—	+ 2·3
			Z	31·0	33·0	32·8	32·5	—	+ 2·0
			Y	29·6	32·0	33·0	32·0	—	+ 3·4
22	Rheumatoid arthritis of knees and hands	3 areas on L. knee	F	29·5	31·7	32·4	—	—	+ 2·9
			Z	29·0	31·2	31·7	—	—	+ 2·7
			Y	31·0	31·7	31·7	—	—	+ 0·7
23	Rheumatoid arthritis of wrists and hands	3 areas (metacarpophalangeal joints) on R. hand	F	27·8	29·2	28·5	27·7	—	+ 1·4
			Z	29·2	31·0	32·0	30·0	—	+ 2·8
			Y	29·2	29·2	29·0	28·8	—	− 0·4
24	Fibrositis of L. trapezius	3 areas over L. trapezius	F	33·5	35·2	35·5	34·8	—	+ 2·0
			Z	33·5	35·0	35·1	34·0	—	+ 1·6
			Y	34·0	35·0	35·5	34·8	—	+ 1·5
25	Fibrositis of R. trapezius	3 areas over R. trapezius	F	33·8	34·0	35·5	36·5	36·5	+ 2·7
			Z	34·2	34·7	36·3	37·0	36·5	+ 2·8
			Y	34·4	34·6	35·6	37·0	36·5	+ 2·6
26	Fibrositis of trapezii	3 areas over R. trapezius	F	34·5	36·5	36·8	36·9	36·9	+ 2·4
			Z	34·0	36·0	36·2	36·5	35·9	+ 2·5
			Y	35·0	35·9	36·5	36·3	36·3	+ 1·5
27	Capsulitis of L. shoulder	3 areas over L. deltoid	F	30·0	33·0	33·0	33·0	—	+ 3·0
			Z	29·8	33·2	33·0	33·0	—	+ 3·4
			Y	30·3	33·8	33·5	33·0	—	+ 3·5
28	Capsulitis of R. shoulder	3 areas over R. deltoid	F	34·0	35·2	—	34·6	—	+ 1·2
			Z	33·5	34·7	—	33·5	—	+ 1·2
			Y	33·5	33·7	—	33·6	—	+ 0·2
29	Fibrositis of R. trapezius	3 areas over R. trapezius	F	34·0	36·2	36·3	36·0	—	+ 2·3
			Z	34·0	35·8	35·2	35·4	—	+ 1·8
			Y	34·8	35·2	35·0	35·0	—	+ 0·4

ment "F" produced a greater rise in skin temperature than the other two ointments in 17 out of the 18 cases of osteoarthritis, in 3 of the 5 cases of rheumatoid arthritis, and in 3 of the 6 cases of fibrositis. With all three rubefacients the maximum rise in skin temperature occurred between 30 and 45 minutes after application.

Discussion

Skin temperature estimations seem to provide an objective means of comparing the effectiveness of rubefacients. It is possible to gain only a general impression by questioning the patients about their pain. Reports obtained in this way from over 100 subacute and chronic "rheumatic" cases seem to indicate that ointment "F" is more strikingly effective in relieving pain than other rubefacients in common use. In some cases in which the patient was able to compare ointment "F" with other ointments which he had used in the past the comparison was nearly always favourable to this product. Thus there appears to be some degree of correlation between the results obtained in the trial and clinical impressions.

If similar results to those described above were to be obtained by other investigators it would appear that a method is available of comparing rubefacients scientifically.

Summary

A comparison between three rubefacient ointments—containing respectively the β-butoxyethylic ester of nicotinic acid and nonylic acid vanillylamide ("F"), histamine ("Y"), and nicotinic acid ester ("Z")—has been attempted by means of skin temperature estimations, tests being carried out on 29 patients.

It was found that ointment "F" produced a greater rise in skin temperature than the other ointments in 17 out of 18 cases of osteoarthritis, in 3 of 5 cases of rheumatoid arthritis, and in 3 of 6 cases of fibrositis.

Acknowledgments

I wish to thank Dr. Clive Shields, Director of the Physical Medicine Department, St. George's Hospital, for advice and for providing facilities to enable this work to be done. I would also thank Dr. S. Linton, of Lewis Laboratories, Leeds, for his help.

CENTRAL COUNCIL FOR THE CARE OF CRIPPLES

The Central Council for the Care of Cripples is arranging a study tour from July 18 to 25, 1955, based on London. This will provide an opportunity for delegates to see practical demonstrations of the services which are rendered to "paraplegics" and sufferers from various forms of rheumatic diseases. Further particulars can be obtained from the Secretary, Central Council for the Care of Cripples (Tour 1955), 34 Eccleston Square, London, S.W.1.

SHOULDER ABDUCTION WITH DELTOID PARALYSIS

By C. B. WYNN PARRY

From the Medical Rehabilitation Unit, Royal Air Force, Chessington

IT may not be widely known that patients with complete paralysis of the deltoid muscle can be taught to gain full abduction and elevation of the shoulder. Electromyography reveals that during normal abduction the biceps, triceps, and infraspinatus muscles are active as well as the deltoid. The rationale of regaining abduction after deltoid paralysis is to utilize the long head of biceps as the anterior fibres of the deltoid, and the long head of triceps as the posterior fibres, though by far the greater contribution to abduction is made by the biceps.

In this short paper are presented a series of cases in which this result has been obtained.

Material

There were fifteen patients in the series, all with paralysis of the deltoid due to the following different causes: traumatic lesions of the upper trunks of the brachial plexus, 5; neuralgic amyotrophy, 3; poliomyelitis, 3; toxic neuritis, 2; and circumflex nerve palsy, 2. In many of the cases other muscles of the shoulder girdle were also affected.

On arrival of the patients at the unit, abduction of the shoulder was limited to a few degrees only and was due to "hitching up" of the shoulder. Clinically the deltoid was paralysed in all cases, and electrical tests, including nerve conduction, intensity duration curves, and electromyography, confirmed the presence of complete denervation.

Method

All patients received full-time treatment, including class exercises, physiotherapy, and hydrotherapy. Occupational therapy was given in selected cases. The first essential aim was to obtain a full range of passive movement in the shoulder-joint. If this was not possible, passive movements after the application of heat (radiant heat or hydrotherapy) and stretching of any tight soft-tissue structures were carried out twice daily. Resisted exercises were prescribed to strengthen biceps and triceps, particular attention being paid to the long heads of these muscles.

In order to restore abduction, the patient lay on his back on a plinth and practised raising his arm from the side; he then sat on a chair in front of a mirror and was encouraged to raise the arm sideways without lifting the shoulder. In the early stages he learns to abduct the arm in external and internal rotation successively in order to allow the long heads of

PLATE XXXIII

C.B.W.

PLATE XXXIII

A. Patient with complete paralysis of left deltoid due to traction lesion of upper trunks of brachial plexus. The wasting is obvious.

B. 100 degrees abduction.

C. Maximum elevation possible.

biceps and triceps to initiate and carry through the movement. The fact that the infraspinatus is not essential for regaining abduction was shown in one patient who regained a full range of movement in the presence of total paralysis of both deltoid and infraspinatus.

Once the patient can achieve 70 degrees of abduction further progress is rapid. Provided the serratus anterior has reasonable power, full elevation is possible when this range has been reached.

Results

All patients regained 160 degrees of movement, but some were unable to obtain 180 degrees with the elbow fully extended. The power of abduction has proved remarkably good, and most patients are able to resist strong pressure in 90 degrees of abduction. The average time taken to obtain the full or near-full range of movement was four weeks, and for maximum power six weeks. A typical case is illustrated in Plate XXXIII.

It is stressed that the abduction obtained in these patients is not a trick movement in the accepted sense of the word, as the movement is in all respects normal and controlled.

Acknowledgments

My thanks are due to Mrs. L. Baker, Superintendent Physiotherapist, who was responsible for the treatment of the patients.

I wish also to thank the Director-General of Medical Services, R.A.F., for permission to publish this paper.

SECOND INTERNATIONAL CONGRESS OF PHYSICAL MEDICINE

PRELIMINARY NOTICE

THE Second International Congress of Physical Medicine* will be held at Copenhagen, Denmark, from August 20 to 24, 1956, under the joint sponsorship of the Danish National League against Poliomyelitis and the Danish National League against Rheumatic Diseases. Dr. S. Clemmesen will act as President, Dr. O. Bøje as Vice-President, and Dr. B. Strandberg as Honorary Secretary. Full details of the Congress, including the programme, will be published later.

* The second congress to be held under the auspices of the International Federation of Physical Medicine.

CLINICAL REPORT

PRIMARY GENERALIZED OSTEOARTHRITIS WITH INVOLVEMENT OF THE STERNO-CLAVICULAR JOINTS

PRIMARY generalized osteoarthritis is now a well-established diagnosis which is made largely on the distribution of involvement of the joints by the degenerative process. The following case is reported because of the unusual involvement of the sterno-clavicular joints, which are much more commonly affected by rheumatoid arthritis and ankylosing spondylitis than by degenerative arthritis.

Case Report

The patient, a housewife aged 73 years, had a gradual onset of painful, hard swelling of the finger joints and thumb bases of both hands over many years. She also noticed occasional pain in the knees on excessive exercise, and for the previous two years had had painful swelling of the right sterno-clavicular joint which was originally diagnosed elsewhere as a dislocation and subsequently as rheumatoid arthritis. She had no constitutional symptoms apart from cough and dyspnoea, and, in particular, no Raynaud's phenomenon or sweating, no rashes or iritis, and no history of trauma.

Examination showed an elderly, obese, emphysematous woman with gross Heberden's nodes and osteoarthritic involvement of the proximal interphalangeal joints (Bouchard's nodes), carpo-metacarpal joints of the thumbs, and knee-joints. The right sterno-clavicular joint showed irregular bony enlargement with crepitus on movement. The movements of the cervical and lumbar spine were also limited. The metacarpo-phalangeal joints, elbows, shoulders, ankles, lateral metatarso-phalangeal joints, and temporo-mandibular joints were clinically normal. There were no nodules or tendon lesions. X-ray examination showed gross osteoarthritic changes with loss of joint space, sclerosis, and osteophyte formation in the affected joints (Plate XXXIV). Some bone cysts were also present, but no erosions of the rheumatoid type. Repeated estimations of the erythrocyte sedimentation rate over three years consistently gave a figure below 11 mm. in one hour (Westergren). Haemoglobin, 96% (Haldane); plasma uric acid, 3·9 mg. per 100 ml.; Rose's test, negative.

Discussion

Heberden's nodes are a well-known feature of osteoarthritis, and Kellgren (1952) drew attention to the more florid picture of primary generalized osteoarthritis, commenting on the similarity to, and points of differential diagnosis from, rheumatoid arthritis and secondary osteoarthritis. He regarded Heberden's nodes or involvement of the carpo-metacarpal joints of the thumbs as essential to the diagnosis at that time, and gave the occurrence in order of frequency of involvement as hands,

Radiographs of (A) the right hand and (B) the right sterno-clavicular joint, showing gross osteoarthritic changes.

Kitchenette fitted up for a disabled housewife.

The patient at work in her kitchenette. Note the ease with which she reaches her utensils.

[W.R. W.R.G.]

PLATE XXXVII

The mobile "kitchen". Other fitments to suit particular cases will readily suggest themselves.

knees, spine (articular facets), and other joints. He did not mention the sterno-clavicular joint.

The case now described satisfies all his criteria for a diagnosis of primary generalized osteoarthritis, and in addition has the unusual feature of involvement of both sterno-clavicular joints, which led to the initial diagnosis of rheumatoid arthritis.

W. St. J. Buckler

Department of Physical Medicine,
Royal Free Hospital.

REFERENCE

Kellgren, J. H., and Moore, R. (1952) *Brit. med. J.*, **1**, 181.

NEW APPLIANCES

KITCHEN UNITS FOR DISABLED HOUSEWIVES

In Plates XXXV–XXXVII are illustrated two types of kitchen unit which have been developed at the Royal Hampshire County Hospital, Winchester, for the use of crippled women patients so that they can attend to their housewifely duties without help so far as they are able.

The kitchenette shown in Plates XXXV and XXXVI was developed for disabled housewives who retain a certain amount of mobility. It is designed on a three-radius principle which brings all the shelves within reach of the sitting patient. The sink is only 6 inches deep to allow her legs to go under it and yet enable her to use her arms comfortably for work in the sink. The normal 11-inch sink was found to be very trying for the user as she was obliged to keep her elbows lifted. The kitchen fitments are made of hardboard and three-ply, and the materials, apart from the sink fittings, etc., cost about £3. The illustration shows a rotating type of seat, but the space provided will accommodate a wheel-chair if necessary. The patient in the picture is a young married woman of 24 with paralysis of both legs who was trained in the Department and is now able to run her home and look after her husband and two children without additional help.

The basic features of the mobile, trolley type of kitchen designed for bed-fast or room-fast patients may be seen from Plate XXXVII. This has been fitted up to enable the patient to prepare and cook meals without, where necessary, moving from her bed. Materials for constructing the trolley itself cost about £1. The "Baby Belling" electric cooker shown in the illustration cost less than £7; it has been in use for some time in the Department and found to cook efficiently.

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INTERNATIONAL SOCIETY FOR THE WELFARE OF CRIPPLES

SIXTH WORLD CONGRESS

THE Sixth World Congress of the International Society for the Welfare of Cripples took place at The Hague from September 13 to 17, 1954, the theme of the Congress being "Changing Attitudes in a Changing World". It was a meeting-place for all interested in the welfare of the cripple, the prevention of disability, and the provision of a full life for the disabled.

Dr. H. H. KESSLER (U.S.A.) urged that everything possible should be done to alter the public attitude towards the cripple to one of encouragement and partnership, emphasizing the great need for this especially in the so-called "backward" countries.

Mr. STANLEY EVANS (United Kingdom) discussed the organization of services for the crippled, while Mr. G. E. SLATER (United Kingdom) spoke of better means of employing the handicapped. Mr. EUGENE TAYLOR, of the editorial staff of the *New York Times*, defined public relations and fund-raising.

Sir GEOFFREY PETO, of the Central Council for the Welfare of Cripples—one of the pioneers of the movement—asked for more help for the "home-bound". Mr. P. G. TREVAHAN, Secretary of the "Goodwill Industry of America", which is responsible for the employment of some 26,000 crippled workers, discussed sheltered work and the "home-bound". He stressed that for this unfortunate section of the community employment must be meaningful and useful, the workmanship acceptable commercially although the pace may be slow, and the programme within the limits set by the individual medical prescription.

A section of the Congress was devoted to cerebral palsy, with Dr. MYER PERLSTEIN (U.S.A.) in the chair; one to spinal paraplegia, under the chairmanship of Dr. L. GUTTMAN, of the Paraplegic Unit, Stoke Mandeville; and another to rheumatism and arthritis with myself as chairman. In the last section Professor GOSLING, of Leiden, stressed the need for undergraduate and post-graduate teaching, for the prevention and early diagnosis of the rheumatic diseases are dependent on a proper recognition of these disorders by the family doctor. Mrs. NEVILL ROLFE, Secretary of the British Rheumatic Association, spoke both as a sufferer and as a propagandist on the social aspect of the problem.

"Rehabilitation: a Means of World Co-operation" was the subject of an address by Dr. HOWARD A. RUSK (U.S.A.). This was delivered in the presence of the Queen of the Netherlands. Dr. A. R. SHAND, jnr. (U.S.A.) urged that rehabilitation should be part of every doctor's training and duty and that Physical Medicine should no longer be its sole sponsor. This speaker made clear some of the difficulties that our American colleagues have to overcome.

The film award was made to "A New Beginning", an American film on the rehabilitation of the injured miner, which was a first-class production. Honourable mention was given to a coloured film dealing with a school for spastic children in Denmark, and to a simple Swiss film entitled "Frère Humanes". These three films deserve to be seen by all members of the B.A.P.M.

The Congress left one with the impression that we in physical medicine could learn a great deal from attendance at such meetings as this which are not controlled by, or confined to, the medical profession. It would help us to realize that a great number of thoughtful and intelligent lay people are doing excellent work in the field of rehabilitation. Incidentally, I am led to wonder if we specialists in physical medicine are taking the lead as I think we should. Another impression gained is that more can often be learned in the coffee room than in the lecture theatre.

Plans are already afoot for the next Congress, which it has been suggested should be held in London in 1957.

FRANCIS BACH

BOOK REVIEWS

Proceedings of the First Congress of the World Federation for Physical Therapy
Published by the Chartered Society of Physiotherapy, London. Pp. 91
12s. 6d.

THIS book provides a remarkably complete day-to-day account of the Congress held in London in September, 1953. On reading the various papers and discussions one is able to appreciate the value of a gathering at which the opinions and methods of experts from many parts of the world can be exchanged. To quote the words of Sir Harry Platt at the opening ceremony: "The urge to meet on an occasion such as this is a manifestation of the questing scientific spirit which knows no geographical boundaries. It represents a desire to escape —even for a short spell—from prosaic routine, to stand on the growing edge of knowledge and to share our enthusiasms with fellow-workers from distant countries."

The contents are arranged chronologically; the subject-matter may be considered under five headings: (1) items of general interest, including the opening and closing ceremonies; (2) lectures, including full reports on the discussions following each; (3) demonstrations; (4) papers by physiotherapists; and (5) brief reports on study visits.

Most branches of physical medicine were considered, and so far as possible a separate aspect of the subject was selected for study on each of the five days of the Congress. The main subdivisions on which papers were read concerned physiotherapy in relation to neuromuscular disorders, rheumatic diseases, diseases of the chest, industry and resettlement, and treatment and research. In spite of a diversity of subjects, one is struck by the insistence of many speakers on the great importance of the recognition of the patient as a person and of the human and psychological approach to his troubles.

Space does not permit mention of more than a few of the papers given, but many deserve careful attention and a record of them is most valuable. The

opening lecture by Seddon was a lucid and instructive account of the pathology and treatment of lower motor neurone disturbances, and this was followed by a stimulating paper from Kabat on his proprioceptive facilitation method of re-education. Increasing interest is being shown in his views in this country, and it is noteworthy that they were in certain respects at variance with those of Seddon. For instance, it appears that Kabat would advocate a much earlier start with treatment of maximal resistance in a case of anterior poliomyelitis. It would be of interest to know of the scientific evidence for certain assumptions on which Kabat bases his opinions; for example, the belief that in minimal volition it is always the same muscle fibres which are called into play, and that "zero" muscles from an upper motor neurone lesion can be trained to activity by inducing extrapyramidal pathways to carry impulses from the cerebral cortex to the anterior horn cell.

An excellent review of our knowledge on fibrositis was given by Wallace Graham, who emphasized the great importance of the psychogenic factor in aetiology and treatment. The physiotherapist was specially considered in a most helpful lecture by Burt on the management of the arthritic patient, and the role which the physiotherapist, as distinct from physiotherapy, can play in treatment was discussed. Plewes gave his views on the treatment of Sudeck's atrophy, and his results have been encouraging.

Many good papers were presented by physiotherapists, and, in particular, Lois Dyer on the treatment of non-Europeans in Africa and Hanne Mossiqe on the care of the cerebral palsied child in Norway were of great interest. The exercises described by R. B. Brookes for the injured shoulder deserve special study.

Considerable time and work must have gone into compiling these records, and much credit should be given to the editor, whose name has regretfully been omitted. Production of these *Proceedings* within six months of the Congress is indeed a remarkable achievement. The book will be of great interest to all those who are concerned with physical medicine but were not able to be present, and it will form a most pleasing record for those fortunate enough to attend.

G. SAVILL

Atlas de Radio-rhumatologie. By FRANÇOIS FRANCON and PIERRE FAIDHERBE. Pp. 80. 840 francs. Paris: Varia.

In this atlas, which contains more than a hundred X-ray photographs each accompanied by a short case history, François Francon, president of the newly formed French Society of Physical Medicine, in conjunction with Pierre Faidherbe, has placed radiology in what, from his long and wide experience, he considers to be its proper place in the practice of rheumatology. He points out that a diagnosis cannot be made just by looking at X-ray pictures. Radiology is, however, essential in making a correct diagnosis, in following the course of the disease, and in controlling the effects of treatment in the majority of rheumatic disorders.

Although of interest to every physician, this book should be of particular value to those who are preparing case records for publication in the *Annals*, even to those whose knowledge of the French language is limited.

FRANCIS BACH

ABSTRACTS OF THE LITERATURE

The Normal Vascular Anatomy of the Femoral Head in Adult Man. J. TRUETA and M. H. M. HARRISON. *J. Bone Jt Surg.*, 1954, **35B**, 442.

In this paper from the Nuffield Orthopaedic Centre, Oxford, is described a study of the blood supply to the femoral head in 36 post-mortem specimens from adults. The specimens were prepared by a series of injection techniques and studied by dissection, radiography, and microscopy of histological preparations.

It was found that the patterns of epiphysial and metaphysial blood supply established during growth persist throughout adult life, the vessels entering the head being named epiphysial and metaphysial according to the origin of the area which they supply. The source of these vessels is the medial circumflex femoral artery, from which arise lateral epiphysial and superior and inferior metaphysial arteries, and the acetabular branch of the obturator artery, which after running within the ligamentum teres is continued as the medial epiphysial artery.

The lateral epiphysial arteries, two to six in number, enter the head posterosuperiorly, and pass parallel to the line of the old epiphysial plate to supply the greater part of the head. The medial epiphysial artery supplies a small part of the head and anastomoses with the lateral epiphysial arteries. Branches from the epiphysial arteries form a series of radially arranged arcades directed towards the articular cartilage. The superior metaphysial arteries, of which there are two to four, enter the superior aspect of the neck, run at first vertically downwards and then turn medially towards the epiphysial scar. The inferior metaphysial arteries enter the head close to the inferior margin of the articular cartilage. There is free anastomosis both between the two sets of arteries supplying each territory and also between the epiphysial and metaphysial arteries across the epiphysial scar.

This is a contribution to the study of the nutrition of articular cartilage by the demonstration of precapillary vessels which arise in the marrow and pass through canals in the subchondral bone to form broad single capillary loops at the deep surface of the calcified cartilage. The authors conclude that the anatomical pathway for the conveyance of nutriments from the subchondral circulation to the cartilage can be said to exist. There was no evidence of any decrease in the circulation within the femoral head with advancing age.

D. J. E. CHESHIRE

Peripheral Arterial Disease: Some Points of Common Interest to General and Orthopaedic Surgery. F. A. R. STAMMERS. *J. Bone Jt Surg.*, 1954, **36B**, 209.

In this paper from the University of Birmingham the author briefly reviews the history of the development of sympathetic ganglionectomy for vasospasm and reviews the present position of investigation and treatment of peripheral arterial disease. These diseases are classified according to their aetiology into five main groups: (1) anatomical; (2) traumatic; (3) embolic; (4) vasospastic;

and (5) arterial-wall disease. Symptoms are discussed in terms of cold sensitivity, trophic changes, and intermittent claudication.

According to the author, investigations are mainly of importance in assessing the degree of vasospasm, for only this element of peripheral arterial disease is influenced by sympathectomy. The patient's history and the response to reflex heating and sympathetic block are of value; but although arteriography has assumed importance since the introduction of arterial grafting, he has not found this a reliable investigation.

Treatment, both conservative and operative, is discussed, the usefulness of reflex heating being emphasized. Certain technical aspects of sympathectomy are dealt with and the long-term results of this operation reviewed. Special points concerning poliomyelitis, acrocyanosis, cervical rib, vascular injuries, and crutch arteritis are made. P. J. R. NICHOLS

The Role of the Muscles in the Aetiology of Headache. D. E. MARMION. *J. R.A.M.C.*, 1954, **100**, 99.

In this paper are described eight cases of persistent or recurrent headache associated with spasms of the neck, jaw, or facial muscles. Demonstrable organic lesions were usually absent, whereas emotional tension or faulty posture was commonly present. Reflex spasm as a result of minor trauma or minor painful defects of the cervical spine or jaw accounted for the remainder. Physiotherapy aimed at reducing the muscle spasm relieved the headache, although it was not always successful in relieving the pain which initiated the attack.

The author states that doctors too frequently approach the problem of headache in a pessimistic and defeatist spirit, failing to examine the head and neck adequately and allowing a vicious circle to develop which increases and perpetuates the headache. J. M. MILNE

Funicular Suture and Funicular Exclusion in the Repair of Severed Nerves. S. SUNDERLAND. *Brit. J. Surg.*, 1953, **40**, 580.

In this paper from the University of Melbourne a plea is made for a more detailed study of the internal anatomy of nerve trunks in an attempt to improve the technique of nerve suture. Funicular suture and funicular exclusion in the repair of severed nerves are described. It is claimed that these methods improve the chances of restoring the original pattern of innervation and of reducing the wasteful escape of regenerating axons, less critical methods resulting in cross-shunting.

Regional injuries to various nerve trunks are discussed and their internal anatomy described. R. J. TALBOT

Inadequate Arch Support in Shoes. R. KENDRICK and G. H. CHAMBERS. *U.S. Armed Forces med. J.*, 1954, **5**, 901.

Examination of U.S. Army recruits with acute or chronic foot strain has frequently revealed the shoes to be at fault, particularly in heavier individuals or those with long, narrow feet. The steel shank piece supporting the shank of the shoe gives way; the shank falls and the heel and toe rise, creating a "rocker-

bottom" effect. Replacement of the defective shank piece by a stronger one capable of maintaining the normal shoe form has resulted in freedom from symptoms.

[This cause of foot strain is commoner than is generally realized, and much time is wasted in treating minor postural foot faults.] J. M. MILNE

Metabolism of Limb Atrophy in the Rat. H. G. B. SLACK. *Clin. Sci.*, 1954, **13**, 155.

In this paper from the Rheumatism Research Centre, Manchester University, the author describes experiments designed to study the changes occurring in collagen during tissue atrophy. Massive atrophy was produced in rats by the denervation and dislocation of the hip of one hind leg, and the uptake and turnover of injected methylene-labelled glycine then studied. An important finding was that the isotopic glycine was taken up at least at the same rate in the operated limb as in the control one, despite the marked atrophy which took place. This state of affairs continued until practically no muscle tissue remained, and it was therefore assumed that protein synthesis continues normally despite gross tissue atrophy.

The author concludes that the enzyme systems responsible for collagen and muscle protein synthesis probably continue to function normally during periods of atrophy, and that wasting itself may be due, not to a failure to synthesize, but to increased activity of some removal mechanism.

R. M. MASON

An Electromyographic Study of Certain Muscles of the Leg and Foot in the Standing Position. J. V. BASMAJIAN and J. W. BENTZON. *Surg. Gynec. Obstet.*, 1954, **98**, 662.

The tibialis anterior, peroneus longus, lateral head of the gastrocnemius, abductor hallucis, flexor digitorum brevis, and abductor digiti minimi of normal men and women were studied electromyographically while the subject was standing in the "at ease" position. A unipolar needle electrode with a ring-shaped skin electrode was used according to Jasper's technique.

The fact that in many cases these muscles showed inactivity while the subject was standing was taken to indicate that these muscles do not play an important role in the normal static support of the long arches of the foot. It is pointed out, however, that this criterion cannot be applied to abnormal feet or to normal feet in locomotion.

In women the wearing of high heels markedly increased the activity of the gastrocnemius and peroneus longus muscles. D. A. BREWERTON

Some Aspects of Cerebral Palsy. G. A. POLLOCK. *Edin. med. J.*, 1954, **61**, 111.

The author traces the development of the care of spastics, noting the classical descriptions of Little in his papers in the mid-nineteenth century and the work of the present day, chiefly in the U.S.A., where Phelps has had a vast clinical experience. A classification of cerebral palsy is presented, and there are clear descriptions and observations on each type. Particular attention is paid to athetoid cases, the author referring to thirty children who had been under his

care for at least a year. He emphasizes the importance of early treatment in these cases, particularly of the deaf athetoid by a skilled otolaryngologist.

It has generally been taught that lesions of the pyramidal tracts, subcortical regions, and precentral gyrus give rise to spasticity; that those found in the basal ganglia and their connexions are responsible for symptoms of athetosis, tremors, rigidities, and dystonia; and that ataxia follows similar affections of the cerebellum, its connexions, and the eighth nerve, the variation depending upon the precise area affected. This pattern, however, no longer meets every case, since some patients considered to be examples of extrapyramidal rigidity were found pathologically to show evidences of aplasia of the cerebellum. Others who, when alive, showed features of athetosis, on autopsy gave evidence of cortical damage only.

The importance of early diagnosis, the family history, and the use of surgery is discussed, the latter in the established cases of cerebral palsy being used to prepare the way for physiotherapy and occupational measures of rehabilitation. In treatment, when relaxation either by Jacobson or visuo-kinaesthetic methods is achieved, muscle-coordinated patterns of movement are developed by the Temple Fay technique.

The further education of the child is briefly reviewed. EUAN DAWSON

Traction for Cervical Nerve Root Irritation. A. STODDARD. *Physiotherapy*, 1954, **40**, 48.

The author describes a modified (intermittent) form of head traction to relieve irritation of the cervical nerve roots which he considers is superior to other methods in current use. After discussing the rationale for the use of the method, he gives his reasons for insisting that head traction should be applied in flexion. He describes his own technique for this and the apparatus he employs, with illustrations. L. D. BAILEY

Structural Changes in the Lumbar Intervertebral Discs. R. I. HARRIS and IAN MACNAB. *J. Bone Jt Surg.*, 1954, **36B**, 304.

In this paper from Toronto the authors first review the normal anatomy and physiology of the intervertebral disk and then discuss the process of disk degeneration. The effect of disk degeneration on surrounding structures is discussed with particular reference to the posterior intervertebral joints, subluxation and degenerative changes in these joints being fully described. The relationship of disk degeneration to symptoms is then touched upon, and there follows an account of the radiological diagnosis of disk degeneration.

[This is a very informative paper and one that is difficult to condense. Those interested in this subject are recommended to read the original.]

D. J. E. CHESHIRE

An Evaluation of Conservative Treatment for Patients with Cervical Disk Syndrome. G. M. MARTIN and K. B. CORBIN. *Proc. Mayo Clin.*, 1954, **29**, 324.

A series of 42 men and 19 women who had had radicular pain in the upper limb, considered to be due to a cervical disk lesion and treated at the Mayo Clinic by cervical traction preceded by heat and massage, have been followed up for periods ranging from six months to five years. Vertical traction was

applied by means of a Sayre sling, with the patient sitting, the average pull being 60 lb., usually for one minute twice daily, and the average number of treatments eight. Many of the patients were instructed how to apply traction at home, using a felt sling suspended from the ceiling while standing and bending the knees.

At the end of the initial period of treatment 41 (67%) of the patients showed definite improvement; dramatic relief was sometimes obtained from traction. On follow-up it was found that 47 (77%) had maintained their improvement and that 12 (20%) had had to undergo surgical treatment; however, none of the patients who had originally had good relief from traction were among the latter group.

The authors consider traction by this method to be a satisfactory form of ambulatory therapy, as it affords relief to most patients with a cervical disk lesion.

B. E. W. MACE

Management of Rheumatoid Arthritis with Prolonged Cortisone Administration. W. S. C. COPEMAN, O. SAVAGE, C. DODDS, J. H. GLYN, and M. E. FEARNLEY. *Brit. med. J.*, 1954, **1**, 1109.

The results in twenty cases of rheumatoid arthritis treated by the oral administration of cortisone in a dosage of 37·5 to 100 mg. daily for one to three years are presented. All patients had previously suffered from arthritis for at least two and a half years; all had been unable to carry out their normal occupations and were regarded as severe cases; and all had had the standard methods of treatment without success. Seventeen patients have been enabled to return to their normal working life, although only fourteen of them are regarded as entirely satisfactory. Two cases are considered as unsatisfactory, but in these the dosage of cortisone cannot be increased because of important toxic effects (hypertension and depression respectively). Gastric complications were noted in three cases, but cortisone was only reduced and not abandoned because of them. The most noticeable improvement occurred in function rather than in signs of joint involvement or in systemic and laboratory signs; in fact in a number of the patients radiological deterioration occurred in spite of subjective improvement.

A. ZINOVIEFF

Use of Phenylbutazone in Rheumatoid Arthritis. M. PEMBERTON. *Brit. med. J.*, 1954, **1**, 490.

A total of 210 patients, 186 of whom had rheumatoid arthritis of static or low-grade activity and 24 osteoarthritis of the hip, were given phenylbutazone by mouth in a daily dosage of 200 to 1,200 mg. with an average of 600 mg. No routine blood counts were performed, but each patient was given a printed sheet listing the principal side-effects, with instructions to report any untoward event. After three months 156 were still under treatment. Of these, 36 found the drug to be of no value and 104 found it of moderate value; in the other 16 considerable benefit was noted subjectively. The erythrocyte sedimentation rate was unaltered in 60%; in the remainder a rise or fall of more than 10 mm. occurred in equal proportions. Toxic effects were noted in 89 cases (42·4%),

severe enough in half of these to require discontinuance of the drug, there being a direct relationship between dosage and the incidence of such cases. In 89% reactions occurred in the first three months and in 75% before the end of the first month, dyspepsia being the most troublesome symptom.

Serum estimations showed that the drug is rapidly absorbed and confirmed that it is slowly excreted, appreciable levels remaining after two weeks. About 15% of the circulating level is metabolized daily. No evidence was found of cumulation, and no correlation between serum level and incidence of toxic effects was demonstrated. A. ZINOVIEFF

A Comparison of Cortisone and Aspirin in the Treatment of Early Cases of Rheumatoid Arthritis. A Report by the Joint Committee of the Medical Research Council and Nuffield Foundation on Clinical Trials of Cortisone, A.C.T.H., and Other Therapeutic Measures in Chronic Rheumatic Diseases. *Brit. med. J.*, 1954, **1**, 1223.

Sixty-one patients between the ages of 17 and 59 with rheumatoid arthritis of less than nine months' duration were treated with the same basic regimen of splinting, physiotherapy, etc., and in addition thirty of them were given aspirin and thirty-one cortisone (in twelve-week periods followed by one week's rest). Aspirin was given in the following dosage: first week, 6 g. daily; second week, 2 g. daily; third to twelfth week, individualized at 1 to 8 g. daily with graded withdrawal in the twelfth week. Cortisone was given as follows: first week, Day 1, 300 mg.; Day 2, 200 mg.; Days 3 to 7, 100 mg. daily; second week, 50 mg. daily; third to twelfth week, individualized at 25 to 200 mg. daily with graded withdrawal in the twelfth week. The assessment of patients, which extended over a twelvemonth, included estimation of the haemoglobin level, erythrocyte sedimentation rate, and general functional capacity; a statement whether the patient appeared to be in remission; and certain objective tests including strength of grip, manual dexterity, ability to walk up and down steps, joint tenderness and range of movement, and the number and site of joints involved.

On each form of treatment the disease was judged to be inactive or only slightly active at the end of one year in about three-quarters of the patients, and two-fifths of the patients were regarded as capable of normal work and activity. The only significant difference between the two groups was that the haemoglobin level and erythrocyte sedimentation rate were slightly more favourably influenced in those having cortisone. A. ZINOVIEFF

La Réhabilitation dans la Polyarthrite Chronique Evolutive. J. MICHEZ and E. COLINET. *Acta physiother. rheum. belg.*, 1953, **8**, 125.

The authors point out that the rehabilitation of patients with rheumatoid arthritis is a more difficult problem than that of traumatic or convalescent cases, in that the illness is always liable to progress. They have reviewed 120 patients suffering from this disease, with particular reference to the degree of incapacity and the stage of the disease. They found that in those who performed heavy work the disease tended to progress rapidly, while in those who enjoyed easy social conditions it often showed arrest at an early stage.

They feel that rehabilitation should be proceeded with prudently, as over-enthusiasm may result in reactivation of the disease. It should be carried out in two stages, the first being to return the patient to the normal conditions of living, and then, when this is complete, to get him back to work. While, so far as possible, patients should return to their former job, work involving heavy manual labour should be forbidden, and if necessary the help of the appropriate authority should be enlisted to enable patients to find suitable occupation. B. E. W. MACE

Degenerative Rheumatoid Changes. G. D. KERSLEY, H. S. BARBER, J. C. F. CREGAN, and H. J. GIBSON. *J. Bone Jt Surg.*, 1954, **36B**, 238.

In this paper from the Royal National Hospital for Rheumatic Diseases, Bath, and the Royal Devonshire Hospital, Buxton, the authors describe three cases of a degenerative type of rheumatoid arthritis in which there were large cystic cavities filled with pus-like material. It is suggested that these large cystic areas may arise in two ways: either by the breaking down of a rheumatoid nodule, or by the filling up of a bursa or synovial pouch with necrotic debris shed from the synovial surface.

Four other cases are described in which disk degeneration and subluxation complicated rheumatoid arthritis of the cervical spine. D. J. E. CHESHIRE

"Pulled Elbow." H. K. MAGILL and A. P. AITKEN. *Surg. Gynec. Obstet.*, 1954, **98**, 753.

"Pulled elbow" is a new name for a partial dislocation of the radial head which occurs exclusively in children. With a longitudinal pull, as in helping a child on to a bus, the radial head subluxates below the annular ligament. In adults this does not occur, as the radial head is larger than the neck, but in children the size of the radial head does not exceed that of the neck until the age of 8 years.

Despite clear physical signs, the condition is usually misdiagnosed as a sprain. The child complains of poorly localized pain in the arm. There is local tenderness together with a "rubbery" resistance to passive supination and extension beyond 160 degrees.

Treatment is by manipulation without anaesthesia. The radial head is held between finger and thumb, and with the other hand the wrist is slowly supinated and extended. The rubbery resistance terminates with a definite click, and following this symptomatic relief is almost immediate. A sling or plaster splint should be worn for one week. D. A. BREWERTON

Convalescence from Poliomyelitis in Children. H. I. WEISER. *Harefuah*, 1954, **46**, 175.

In this paper the author describes the epidemics of poliomyelitis that occurred in Israel during 1950-51 and their treatment by rest and progressive resistance exercises. Of 2,300 patients, 85% were under 5 years of age and 71% under 3 years of age.

The treatment he advocates consists in complete rest for four to six months

followed by gradually progressive resistance exercises. These are carried out either by the parents, who have been trained by a physiotherapist, or by the physiotherapist herself. In a comparatively short time innervated muscles are said to hypertrophy. Hot packs or warm baths were found to give great relief where painful rigidity of muscles existed. In summer, however, great care had to be taken with infants on account of the humidity and high room temperatures. Directions are given for exercising affected muscles, with a table showing their development after two months' intensive treatment.

The results achieved by parents alone over a period of two months are presented. Fourteen cases in children between 1½ and 4 years of age who had previously received treatment elsewhere, consisting of massage, exercises in water, and passive and active exercises, were helped considerably, and function was improved up to 49% after only 9 to 20 months' treatment.

The method has now been in use for three years, and the author points out that its advantages are its simplicity and the simple apparatus necessary for the performance of the exercises. MYER FISHER

A Play-pen Pad that Trains Infants to Walk Correctly. M. H. HERZMARK. *Brit. J. phys. Med.*, 1954, **17**, 150.

The author gives an interesting account of the aetiology of acquired flat-foot. In learning to stand the infant broadens his base by separating his feet, and adds a little more base by turning his feet out. Such a stance, by shifting the body weight to a more central axis, depresses the longitudinal arch and everts the heel. As walking on a flat, hard surface offers no challenge to the intrinsic muscles, a habit of walking with pronated feet becomes established—a habit which may persist throughout life.

In order to simulate the resilience and irregular surface of an outdoor terrain, a sponge plastic pad set with convex knobs is recommended as a flooring for infants' play-pens. Such a pad prevents the pronated stance; also, by causing constant changes in balance, automatically exercises those muscles of the foot and leg which tend to support the arch. J. I. WAND-TETLEY

We regret to announce the death on November 18 last, at the age of 77, of Sir Robert Stanton Woods, who had been physician in charge of the Department of Physical Medicine at the London Hospital. He had also been Consultant in Physical Medicine to the Emergency Medical Service during the war. Recently he was appointed an Honorary Member of the British Association of Physical Medicine.